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AUTHOR Inoue, Yukiko
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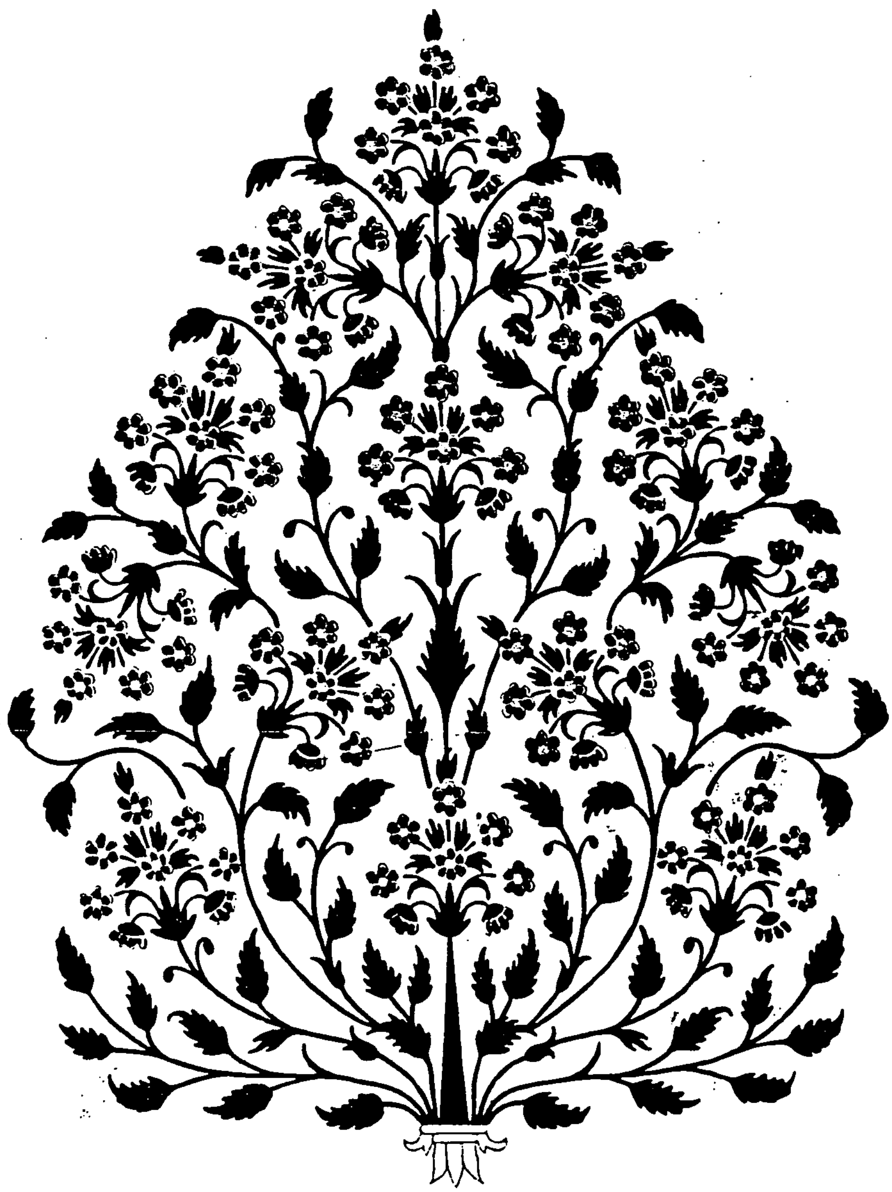
ABSTRACT

In a question-and-answer format a number of topics related to learning and cognitive theory in educational applications are discussed. Most of the discussions consider the contrast between U.S. and Japanese educational practices. The topics include: (1) behavioral and cognitive approaches to learning; (2) metacognition and its implications for learning; (3) recent criticisms of the educational theories of J. Piaget; (4) the functioning of humans and computers; (5) stereotypes; (6) attribution theory and its implications; (7) "blue bird and red bird" (motivational types); (8) humans as limited information processors; (9) sex role differentiation; (10) behavioral objectives; (11) schools planned exclusively for at-risk students; (12) human memory and tape recording; (13) the prepositional network and its implications; (14) developing retrieval strategies; (15) means-end analysis; and (16) self-regulated learning. Four appendixes discuss Siegler's four rules for novice to expert progression, information processing, sex differences in task performance, and learning tactics and strategies. (Contains 24 references.) (SLD)

LEARNING AND COGNITIVE THEORY APPLIED TO EDUCATION

Yukiko Inoue, Ph.D.
College of Education
University of Guam
UOG Station, Mangilao, Guam 96923
Phone: 671-735-2447; Fax: 671-734-3651
E-mail: yinoue@uog.edu



Americans regard education as the means by which the inequalities among individuals are to be erased and by which every desirable end is to be achieved --- George S. Counts (Kearny & Crandall, 1984, *The American Way*, p. 161)

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1. What are main differences between the behavioral and the cognitive (NOT Piaget!) approaches to learning?

"Cognitive" refers to mental processes such as the memory, judgement, and reasoning, whereas "behavior" refers to the action, and activities of an organism. The cognitive approach to learning implies that students actively discover knowledge, gain insight into learning. In Chamot and O'Malley's (1986) view, the cognitive academic language learning approach (CALLA) students are taught to use learning strategies derived from a cognitive model of learning as aids to comprehension and retention of concepts in the content area.

In the behavioral approach to educating, on the other hand, students' specific behaviors (academically and socially) are observed, measured, and analyzed in order to bring about more appropriate behavioral responses. Goal-directed behaviors are more efficient cognitively than behaviorally because they involve fewer random stimuli to consider (Marzano, 1987). Cognitive Theory views learning as an acquisition of knowledge and cognitive structures due to information processing, focusing on the brain processing such as the memory and expectation. Behavior Theory views learning as a change in the form or frequency of behavior as the consequence of environmental events, focusing on the way in which the stimulus-response relationship is formed. Additionally, Watson and Skinner's theory of behaviorism that behaviors are learned and it is possible to change almost any behavior by altering the individual's environment base behavior modification (therapy) upon the principles.

2. What is metacognition and what are the implications for education?

Bruer (1993) identified metacognition as "abilities to think about thinking, to be consciously aware of oneself as a problem solver, and to monitor and control the mental processing" (p.15). Generally metacognition is viewed as the characteristics of expert performance. Compared to novices, as Schunk (1991) wrote, experts

1) possess more declarative knowledge,
2) have better hierarchical organization of knowledge,
3) recognize problem formats more easily,
4) monitor their performances more carefully, and
5) understand the value of strategy uses. (p. 200)

Expert chess players see configurations and familiar patterns of pieces on the board, whereas poor players see individual pieces (Bruer, 1993). In skilled reading, much information is processed automatically, which is very important because of the limitation of working memory (Schunk, 1991). The characteristics of experts can be thus applied to many types of cognitive activities such as reading comprehension, writing, and problem solving that teachers can use to help students develop their metacognition skills. Such metacognitive abilities begin to develop around age five to seven and continue throughout the time children are in school (Schunk, 1991) and learning is the process whereby novices become more expert. Siegler's four rules for the balance-scale task (see Appendix A), which is a classic example of "novice-to-expert performance," can be used as an implication for metacognition. The rules suggest that the differences in learning the balance scale are highly similar to the difficulties in other school learning domains such as mathematics, sciences, and literacy skills.

3. *What are some recent criticisms of Piaget? Do you consider them valid? Why or why not?*

According to Smith (1985), some of the criticisms are that Piaget's work is bleak and negative in its educational implications because of the following given points: 1) Piaget himself had no real interest in education, 2) Piaget's cognitive development proceeds from absence to presence of logical ability, 3) Piaget's theory requires a commitment to the matching principle, 4) Piaget's theory reduces the role of transmission in teaching, and 5) Piaget's model of the mechanism of development is either false or intestable.

With respect to the first point, Piaget wrote only one book on education, and he expressed a lack of interest in how children's cognitive development can be accelerated, but those facts do not prove that he had no real interest in education. Second, Piaget's account does not make an absolute claim that a child has no logical ability, but claims that a child has less logical ability, than an adult. Third, Piaget's account does not require a commitment to the matching principle because there are reasons for basing the principle of optimal mismatching in his work and for denying that an education principle can be derived from a psychological theory. Fourth, Piaget's theory does place a limit on the scope of teacher's talk that is directed upon the transmission of knowledge. Finally, this is not to claim that Piaget's model is confirmed, but to claim that his model is no more objectionable than the alternative. In the final analysis, therefore, the criticisms are not valid because none of the critical points are acceptable.

4. *How is the functioning of the human mind like/dislike that of the computer?*

One of the central metaphors of the information age is that the human mind is a computer. Just as the human mind has functions that receive data, store them in memory, and retrieve them as needed, so the computer system has functions that accept data, process them, and display information (see Appendix B). The computer systems can handle enormous amounts of data quickly and accurately; however, the systems operate under the control of the software that was programmed by people. Computers are therefore good for the tasks, which do not require insight or intuition. In Grinstein and Yarmish's (1981, pp. 158-159) words,

* Humans can read. Computers can "read" words and sentences typed on the keyboard.
* Humans can understand. Computers can understand words that it recognizes and knows.
* Humans can write. Computers can make known its reactions in many ways such as through displaying replies on screens.
* Humans can compute. Computers can perform endless sequences of repetitive operations on given data.
* Humans can remember, but the details of memory tend to fade. Once the computer receives data, it remembers them.
* Humans can analyze. Computers can analyze situations, which are logically and/or mathematically structured.

In effect, "Human minds have an intuitive intelligence that reasoning machines simply cannot match" (Dreyfus & Dreyfus, 1986, p. 44). After all, computers may never think as human beings do.

5. What is a stereotype? Are stereotypes inherently "bad"? Why or why not? Why do people use stereotypes?

Stereotyping, in short, is a biased generalization. The International Dictionary of Education defines it as "a fixed set of greatly oversimplified attitudes or beliefs held generally by the members of groups" (Page, Thomas, & Marchall, 1977, p. 324).

Though sex-role stereotypes, for instance, seem to have been a persistent feature of human culture, they are inherently bad. Children develop sex-role stereotyped views of the world while still young, and the biased views have significant impacts on children's cognitive processes (Cann & Palmer, 1985), resulting in interference with the children's generalizations. From a different perspective, sex-role stereotypes may be viewed as useful guides to children's socialization until their cognitive capacities mature.

Typical stereotypes suggest that boys are inherently aggressive and girls are inherently passive, and those boys are good in math and girls are good in the language arts. With regard to the views, Kimura (1992) showed convincingly that men outperform women in mathematical reasoning and women have greater verbal fluency (see Appendix C). This phenomenon occurs because the effects of sex hormones on brain organization occur so early in life that from the start the environment is acting on differently wired brains in boys and girls.

In the final analysis, therefore, even though they are biased generalizations, people use stereotypes, not because they are widely known and perpetuated, but because people have learned them as part of their cultures from generation to generation.

6. What is attribution theory? What are some implications for teachers?

Attribution theory is concerned with the constant search for the causes of the successes and failures. Students attribute their academic successes and failures to four main causal factors: native ability, effort, task difficulty, and luck (Schunk, 1991). For example, "I got a good (bad) grade in English because of my ability and effort (poor teaching and bad luck)."

The following three continuums, in Hunter and Barker's (1987) view, are useful implications for attribution theory for teachers include:

(1) Locus of control is essential because with teachers' accurate diagnosis (where students' learning leaves off) and effective teaching, students' efforts should bring success.
(2) Stability is important because teachers have to convey to students the belief that their ability to be successful is stable and that they control the effort necessary for success.
(3) Controllability is the way a teacher responds to a student's success of failure, signaling the teacher's belief regarding the student's control of success or failure.

Of all the attributions, only "effort" is controllable and others (ability, task difficulty, and luck) are not controllable; therefore students need to know that "ability plus effort equals success." In addition to implications for attribution theory, Horgan (1990) emphasized the need for attribution retraining as part of cognitive therapy because the lack of perceived control is the basis of unhealthy attributions.

7. *What are blue birds and what should we do about them?*

Blue birds imply so-called low motivated, play-oriented, poor experienced students (people), as opposed to red birds who are high motivated, school-oriented, experienced students (people). The differences between the two types can be summarized as follows:

Red Birds	*Blue Birds*
* Internal locus of control	* External locus of control
* Large background	* Small background
* School-oriented	* Not school-oriented
* Teacher's expectation is high	* Teacher's expectation is low
* Well-organized knowledge	* Poorly organized knowledge
* Positive attributions	* Negative attributions
* Good retrieval strategies	* Poor retrieval strategies
* Good learning skills	* Poor learning skills
* The smart get smarter	* Progressively farther behind

Schunk (1991) discussed many theories: Atkinson's achievement motivation theory (motivation is the process whereby goal-directed behaviors are instigated and sustained), self-worth theory (which focuses on the motivation to task-specific beliefs), attribution theory (attribution is important because it influences beliefs, emotions, and behaviors), and social cognitive theory (which views motivation as resulting from goals and expectations). In light of all the theories, the combination of basic human needs (Maslow's hierarchy of needs) and motivation model can be useful for teaching students like blue birds, who must be given every opportunity to realize their dignity and worth as individuals; eventually, the goal-oriented and value-oriented approach to learning may be the best method for them.

8. *What is meant when we say, "humans are limited information processors"? What are the implications of that statement for educators?*

Information processing, whether in humans or in machines, does comprise two separate domains: Hardware and software. In psychobiology, the functioning of hardware means the physical interconnections of neurons and intraneuronals affected by learning. Software refers to the ways in which data are referenced, accessed, and manipulated. Because humans cannot process a vast amount of data to produce information quickly, completely, and accurately, they are called "limited information processors." However humans are active processors of information, whose memory banks differ from those in computers.

Two human information processing models described by Schunk (1991) are the dual-memory model (see Appendix B) and levels of processing model. The former implies that information is stored for a short time in short-term memory (STM) and then is rehearsed and encoded for storage in long-term memory (LTM). The latter focuses on three levels of processing information: Physical (surface), acoustic (phonological, sound), and semantic (meaning). Detailed information is lost if it is not stored in LTM, but human memory goes through a process of reconstruction from the abstracted cues, which are remembered. Information is stored precisely in a computer, whereas human memory is less precise but colorful or informative (Schunk, 1991). Humans process many items at the same time, whereas computers do one thing at a time. Therefore, it is important to take these factors into consideration when determining "how to improve memory" (see Appendix D).

9. Teachers should discourage any and all types of sex role differentiation. Preschool teachers should do away with the "housekeeping corner." Agree or disagree? Why?

It seems that by age six or seven, a child usually exhibits a strong gender identity, making sex-typed choices and preferring same-sex peers. This brings to mind the remark of five-year old girl: "I want to be a lady, not a woman." She was a child, but she exhibited the gender identity. Until recent years in Japan, women have been taught at school as follows: "As a child, obey your father; when married, obey your husband; when old, obey your son. This is the correct way for women to live." The way of training children to become adults is performed mainly by the schools. An education system transmits a body of facts to children; also it serves to preserve the fundamental values of the culture (including gender identity) by passing them from one generation to the next.

In America schools foster a belief in the worth of the individual and the value of competition, whereas in Japan students are taught respect for a dedication to authority that may become blind allegiance. As a result, "at the age of twenty, Japanese girls have not yet discovered the realities of the adult world and respond only to a vague conception of what they are and should be" (Birat, 1988, p. 55). Preschool teachers, therefore, "should commit themselves to teach in a nonsexist way daily" (Gillis, 1981, p. 185), because teachers might be more important factor in perpetuating sex-role differentiation at school than any other factors and they should keep the housekeeping corner as a method of teaching the functional components or basic human life.

10. Every course should have behavioral objectives, right or wrong? Discuss how behavioral objectives can improve the learning process. Discuss ways in which they can get in the way. Explain what level/subject you might teach and whether or not you'd like to use behavioral objectives. Give an example or two of what appropriate objectives might be for your use.

Because increased specificity in educational objectives, as Popham (cited in Marzano, 1987) identified it, produces increased specificity in instruction which produces better learning), every course should have behavioral objectives. In brief, behavioral objectives are statements concerning the observable behaviors that students are expected to learn and express during or after the course. The learning process would be slowed down without behavioral objectives that serve to define the direction of the course. Therefore, behavioral objectives will set the precedent for learning. To ensure future success, behavioral objectives should be used throughout the high school level.

In Japan, three subjects (Japanese, Mathematics, and English) are emphasized as most important among all subjects taught in schools. In case of teaching at a Japanese high school, behavioral objectives would be appropriate to use in relation to the three courses. Objectives required upon completion of these courses include the following: 1) Read and understand contemporary as well as classical Japanese literature; 2) solve simultaneous linear equations with five variables using matrix algebra; and 3) conduct a conversation in English using 2000 vocabulary words. In Japan, the above subjects are indispensable for taking an entrance examination for colleges. Also the knowledge gained from the subjects is important is daily life to be successful citizens.

11. Dr. House is considering starting a separate school exclusively for at-risk boys. This would be an Acrocentric middle school, which would emphasize black culture, build self-esteem, and promote responsible male behavior as well as emphasize academics. Most of the teachers would be African American men. She is not concerned about this constituting racial segregation since most of these boys are already in all black schools. She has appointed you to an advisory committee. What are your recommendations and why?

Indeed it is hard for the Japanese student to answer this questions because Japan is a small, and homogeneous country, where the issues of at-risk students (for example, who drop out, become teenage mothers, and those who are illiterate) are not serious yet. The population of the United States, on the other hand, includes a large variety of ethnic groups coming from many races, nationalities, and religions. Many at-risk students, according to James and Canales (1993-94), never reach their intellectual potential because cultural differences, language barriers, physical and mental handicaps, as well as socio-economic problems impede their success in school and in life, in general. Therefore, Dr. House should not start at school exclusively for at-risk boys. Many of these boys may be from low income and minority families. Instead of that, it is important to try to reach every at-risk boy through counseling, tutoring, and learning motivation. In order to overcome the issue, effective educational programs, which are quite different from the traditional school model, should be developed to meet the needs of the at-risk boys.

Finally, though the idea of a new school is wonderful, the school policies such as emphasizing black culture, and having most African American male teachers require careful consideration.

12 How is memory different from a tape recording? Discuss how students use schemata and how they construct memories. What are the educational implications?

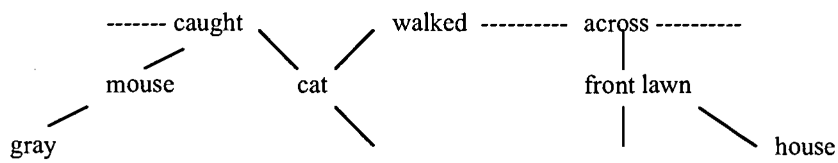
Malik (1979) made it quite clear that in the level of the brain's cortex, words, sentences, or literary texts really do not exist as entities. This means that only a minor quantity of information from the text is stored in memory, whereas a tape recording can capture a compute record of the text. In math problem solving, for example, Tsai and Derry (1987) states that good solvers 1) identify the schema of the problem, 2) substantiate the slots with problem information, 3) verify the schema identification, 4) execute the appropriate procedural attachment to generate the answer, and 5) check to see whether the solution is appropriate. In readying, Garner (1982) wrote that good readers 1) demonstrate spontaneous use of text look-backs to retrieve unrecalled information needed to resolve a cognitive task, 2) have a greater facility for summarizing texts, 3) are good in choosing intermediate level information in text as external memory aids. Schema is important during teaching and for transfer (Schunk, 1991). When teaching a general schema for describing geographical formations (mountain, volcano), the schema might contain the following attributes: height, material, and activity. When hearing a story, students recall the story schema and gradually fit information into it. Thus learner activities may be the most efficient means for stimulating cognitive processing including note-taking, and outlining of presented materials. In sum, students can learn best by inducing schemata for the task.

13. What is a propositional network and what are the educational implications?

A "proposition" may be defined as the smallest unit of information that can be judged true or false (Schunk, 1991). In short, propositional networks represent small pieces of knowledge, which are organized into a larger network or schemata.

Sample propositional network Propositions

"The cat walked across the front lawn."
"The cat caught a mouse."



Source: From Schunk (1991), *Learning Theories*, p. 163.

The figure above explains that the common element is "cat" and students can imagine that the former proposition is linked with other propositions relating to one's house, whereas the latter is linked with propositions about mouse. Accordingly, students store information at the highest level of generality. Information in permanent memory is thus highly organized. Using Propositional networks enables teachers by the use of diagrams to help students have better understanding of visual relationships. The propositional links are based on logic, which may appeal to students. The networks are used to arrange knowledge in computers. Such knowledge gives more intellectual computer-aided instructions; also it is used in "expert systems" because of the explanations which are derived from the propositional networks.

14. Some people have argued that the problem in memory is not storage but retrieval. How can teachers help students develop strategies for retrieving what they have learned?

"Memory" is said to be a characteristic of human frailty. According to Gozzi (1991), nevertheless, human memory is "a complex process which involves abstracting out key elements of the memory, accommodating the new information to already-existing structures in the brain, and assimilating the new memories into the working memory structures " (p. 3).

Teachers can help students develop strategies for retrieving. Retrieval depends on what gets through available strategies and pathways: 1) elaboration, 2) deep processing, 3) organization, and 4) mnemonics. Elaboration assists encoding and retrieval because of linking the to-be-remembered information with other knowledge. Students who elaborate the advantage of information system (IS) in human resources management (HRM) link the new information with what they know about IS and HRM. In deep processing, the more students struggle with a problem-solving strategy, the more easily they can remember the way they solved the problem.

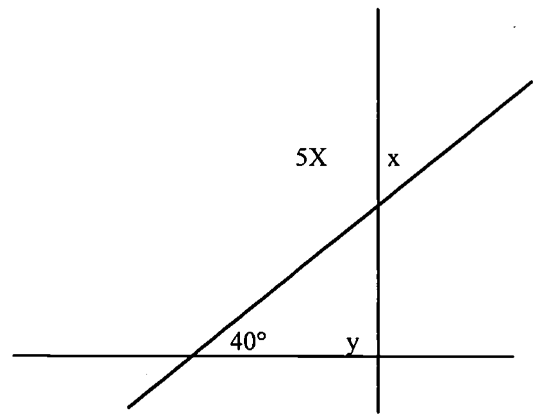
Organization occurs by breaking the idea to be remembered into parts and specifying relationships between those parts: In studying a computer system, organization might involve breaking the system into four components (input devices, central processing units, output devices, and storage devices), and breaking each of these into sub-parts. Mnemonic devices involved making connection between unlike things, as in the example from Schunk (1991): My very educated mother just served us nine pizzas, in which the first letters correspond to those of the planets (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto) (p. 157).

15. What's a means-ends analysis? Givean example from a domain in which you work?

Means-ends analysis (MEA) is a powerful problem-solving heuristic (Schunk, 1991). The operation of means-ends analysis involves attempts at reducing differences between problem states and goal states (Sweller & Levine, 1982). Problems usually consist of 1) givens, b) operations, and c) goals and there are two kinds of strategies: Domain-specific and domain-General. Along with analogical analysis and brainstorming, means-ends analysis is a useful general strategy, whereby students 1) compare the present situation with goal to identify the differences between them, 2) set a sub-goal to reduce one of the differences, 3) perform operations to reach the sub-goal, and 4) repeat the process until the goal is attained. Working backwards is frequently used to prove geometric theorems. For example,

Q: In the figure find the degree measure of angle y.

A: Working backward, since angle x and angle 5x are supplementary (their sum is straight line, or 180°), then **5x + x = 180°**, and therefore, **x =** °. So the third angle of the triangle within the intersecting lines is the vertical of x, or 30°. The three angles of the triangle are thus 30°, 40°, and y. Therefore, **30 + 40 + y = 180.** So **y = 110°**



16. What are some things you could do in your field to encourage self-regulated learning?

Self-regulated learning is identified as the fusion of skill and will, referring to people's development of different learning strategies (Garica, 1993). It is therefore the process in which people personally activate and sustain behaviors, cognition, and effects that are systematically oriented toward the attainment of learning goals (Zimmerman cited in Schunk, 1991).

For instance, for improving writing skills in English, there are many strategies that are used to encourage self-regulated learning. First strategies in the Reinforcement Theory promote self-monitoring, self-instruction, and self-reinforcement methods. Second strategies in the Social Cognitive Theory promote self-observation, self-judgment, and self-reaction. These three sub-processes are important to the perceived progress of learning. Third strategies in Information Processing Theory include both learning strategies and learning tactics (see Appendix D) that are effective ways to enhance positive outcome expectations and attitudes. Finally, the applications of verbalization (self-talk) in Cognitive-Developmental Theory are helpful to build the confidence in systematically working through the long process of improving writing skills in English.

The variety of concepts in self-regulated learning has been proved to be useful. Now self-regulated learning, as Dahl (1992) noted, can be used to further research how self-regulated learning influences adults and if there are any meaningful differences between adult and younger students in self-regulated learning.

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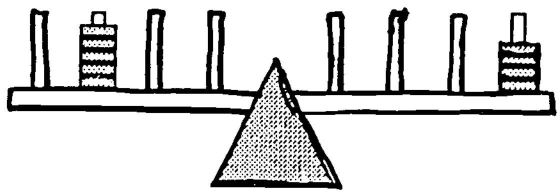
APPENDIX A

WILL THE SCALE TIP LEFT, TIP RIGHT, OR BALANCE?



The 5-year-old—who considers only weight—says the left side will go down. The 13-year-old—who understands there's a conflict here but doesn't know how to figure it out—makes an educated guess. The expert, invoking the law of torques, says the right side will go down.

This is a classic example of novice-to-expert progression. Young children develop simple rules that will work with simple problems. Some children modify those rules when they encounter problems their current rules can't solve. Other children don't. By knowing in some detail what stages children typically pass through on their mental journeys from novice to expert—including the roadblocks and deadends—we can help them progress along the path.

RULE I

- P1 **IF** weight is the same **THEN** say "balance."
- P2 **IF** side X has more weight **THEN** say "X down."

This is the rule that 5-year-olds most often use—for *all* problems. They only consider weight; they don't really notice the distance the weight is from the fulcrum.

RULE II

- P1 **IF** weight is the same **THEN** say "balance."
- P2 **IF** side X has more weight **THEN** say "X down."
- P3 **IF** weight is the same **AND** side X has more distance **THEN** say "X down."

As children progress, they begin to consider distance, but only when the weights on the two sides are equal.

RULE III

- P1 **IF** weight is the same **THEN** say "balance."
- P2 **IF** side X has more weight **THEN** say "X down."
- P3 **IF** weight is the same **AND** side X has more distance **THEN** say "X down."
- P4 **IF** side X has more weight **AND** side X has less distance **THEN** make an educated guess.
- P5 **IF** side X has more weight **AND** side X has more distance **THEN** say "X down."

By age 13, almost all are using this rule, and—with the proper kind of instruction—5 and 8-year olds can be taught to use it. Notice in P4 that the Rule III user can only make an educated guess when it comes to solving problems where one side has more weight but less distance.

RULE IV

- P1 **IF** weight is the same **THEN** say "balance."
- P2 **IF** side X has more weight **THEN** say "X down."
- P3 **IF** weight is the same **AND** side X has more distance **THEN** say "X down."
- P4 **IF** side X has more weight **AND** side X has less distance **THEN** compute torques: $t_1 = w_1 \times d_1$; $t_2 = w_2 \times d_2$.
- P5 **IF** side X has more weight **AND** side X has more distance **THEN** say "X down."
- P6 **IF** the torques are equal **THEN** say "balance."
- P7 **IF** side X has more torque **THEN** say "X down."

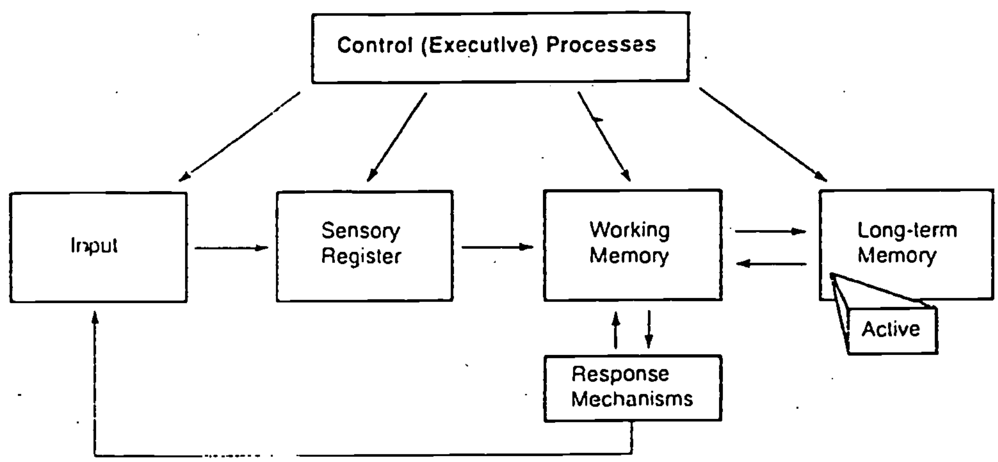
This is the set of rules an expert might use. Now P4 has progressed from an educated guess to the law of torques: Multiply weight by distance on each arm to find the torque; the side with the larger torque goes down. The expert doesn't always use P4; only when the easier rules won't suffice. Almost no one progresses to Rule IV spontaneously, that is, without being taught.

Figure 1
Siegler's rules I-IV for the balance-scale task. (From Siegler and Klahr 1982, p. 198. Used with permission of Lawrence Erlbaum Associates.) Commentary by John T. Bruer.

APPENDIX B

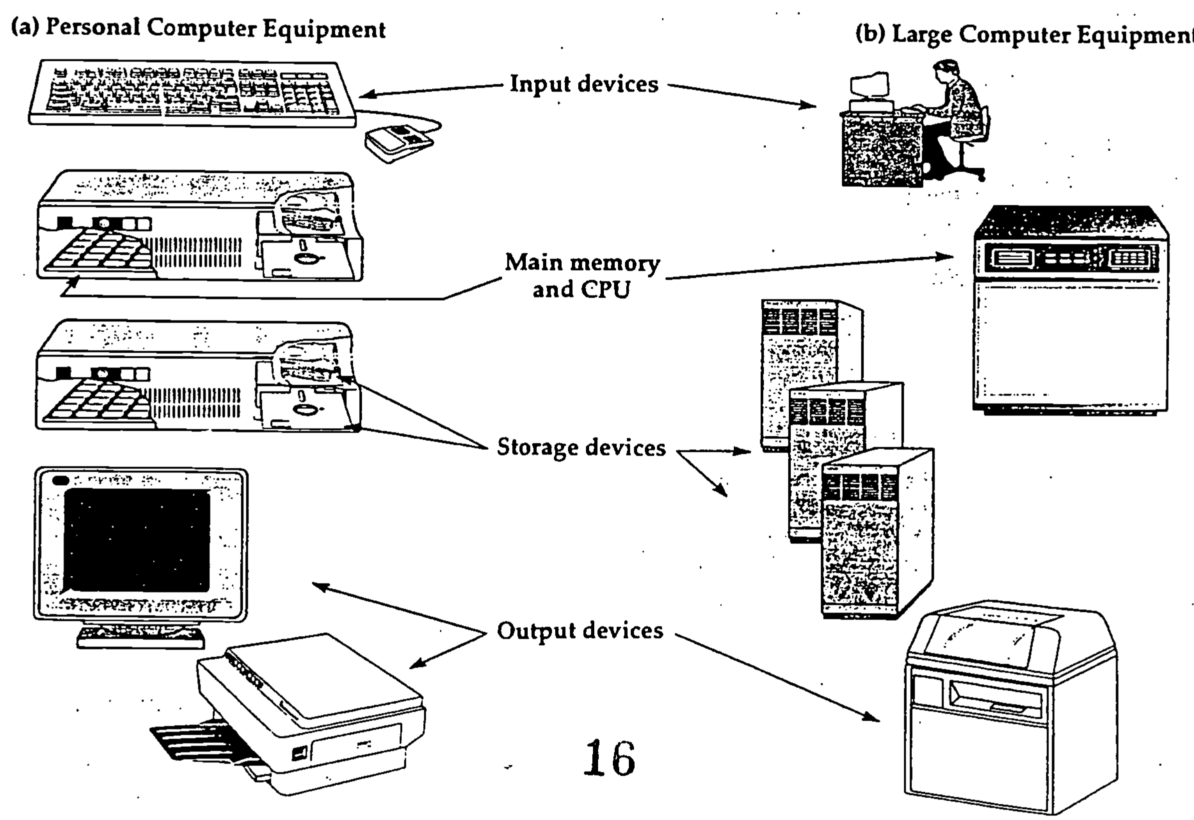
INFORMATION PROCESSING: THE HUMAN MIND AND THE COMPUTER SYSTEM

* INFORMATION PROCESSING MEMORY MODEL



Source: From Schunk, *LEARNING THEORIES: AN EDUCATIONAL PERSPECTIVE*, 1991, P. 140.

* THE COMPUTER SYSTEM. It consists of the following hardware components: input devices; main memory and the processor; output devices; and storage devices.



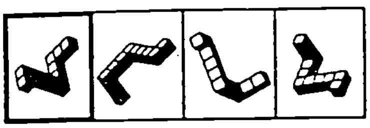
Source: From Stern & Stern, *COMPUTING:IN THE INFORMATION AGE*, P.7.

APPENDIX C

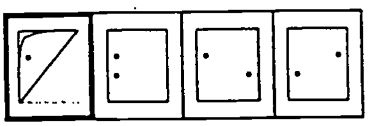
BOYS ARE GOOD AT MATH AND GIRLS ARE GOOD AT LANGUAGE ARTS!?

Problem-Solving Tasks Favoring Men

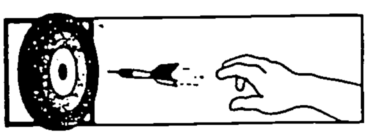
Men tend to perform better than women on certain spatial tasks. They do well on tests that involve mentally rotating an object or manipulating it in some fashion, such as imagining turning this three-dimensional object



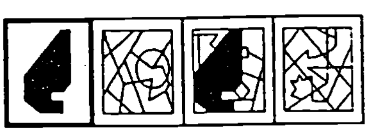
or determining where the holes punched in a folded piece of paper will fall when the paper is unfolded:



Men also are more accurate than women in target-directed motor skills, such as guiding or intercepting projectiles:

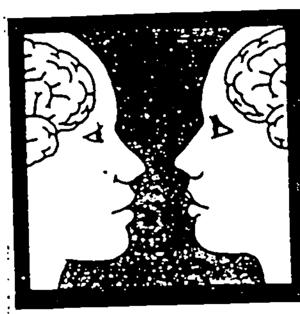


They do better on disembedding tests, in which they have to find a simple shape, such as the one on the left, once it is hidden within a more complex figure:



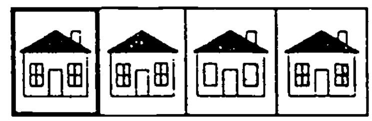
And men tend to do better than women on tests of mathematical reasoning:

1,100	If only 60 percent of seedings will survive, how many must be planted to obtain 660 trees?

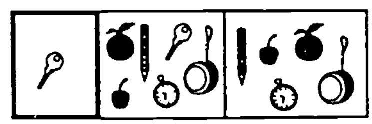


Problem-Solving Tasks Favoring Women

Women tend to perform better than men on tests of perceptual speed, in which subjects must rapidly identify matching items–for example, pairing the house on the far left with its twin:



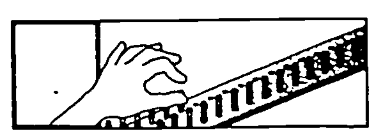
In addition, women remember whether an object, or a series of objects, has been displaced:



On some tests of ideational fluency, for example, those in which subjects must list objects that are the same color, and on tests of verbal fluency, in which participants must list words that begin with the same letter, women also outperform men:

L---	Limp, Livery, Love, Laser, Liquid, Low, Like, Lag, Live Lug, Light, Lift, Liver, Lime, Leg, Load, Lap, Lucid ...

Women do better on precision manual tasks–that is, those involving fine-motor coordination–such as placing the pegs in holes on a board:



And women do better than men on mathematical calculation tests:

77	$14 \times 3 - 17 + 52$
43	$2(15 + 3) + 12 - \frac{15}{3}$

Source: Adapted from Kimura, 1992, pp. 120-121.

APPENDIX D

LEARNING STRATEGIES

Step	Learner Tasks
1. Analyze	Identifying learning goal, important task aspect, relevant personal characteristics, and potentially useful learning tactics.
2. Plan	Formulate plan: "Given this task _________ to be done _________ according to these criteria _________, and given these personal characteristics ______, I should use these techniques ____________."
3. Implement	Employ tactics to enhance learning and memory.
4. Monitor	Assess goal progress to determine how well tactics are working.
5. Modify	Change nothing if assessments positive; modify the plan if progress is deemed inadequate.
6. Metacognitive Knowledge	Guide operation of steps

Source: From Snowman, adapted in Schunk (1991), p. 283.

LEARNING TACTICS

Category	Types
Rehearsal	Repeating information verbatim
	Underlining
	Summarizing
Elaboration	Using imagery
	Using mnemonics: acronym, sentence, narrative Story, pegword, method of loci, keyword
	Questioning
	Note taking
Organization	Using mnemonics
	Grouping
	Outlining
	Mapping
Comprehension	Self-questioning
	Monitoring
	Rereading
	Checking consistencies
Affective	Coping with anxiety
	Having positive beliefs: self-efficacy, outcome expectations, and attitudes
	Creating a productive environment
	Managing time

Source: From Weinstein & Mayer, adapted in Schunk (1991), p. 285.

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Signature: Yukiko Inoue

Printed Name/Position/Title: Yukiko Inoue, Ph.D./Assist. Professor,College of Education

Organization/Address:
University of Guam
College of Education
UOG Station, Mangilao, Guam
96923

Telephone: 1-671-735-2447

Fax: 1-671-734-3651

E-mail Address: yinoue@uog.edu

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